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KNOWLEDGE MANAGEMENT IN THE LEARNING ECONOMY

Dr.R.Ramaabaanu,

Associate Professor,

Department of Commerce,

Muthayammal College of Arts and Science,

Rasipuram.

S.Rajakumari,

S.Bagyalakshmi,

Research Scholars

Department of Commerce,

Muthayammal College of

Arts and Science, Rasipuram.

ABSTRACT

The purpose of this paper is to show why the establishment of 'learning organisations' must be a central element of knowledge management - especially in firms operating on markets where product innovation is an important parameter of competition. The argument straddles and combines insights related to management and organisation theory with an evolutionary economic analysis of the relationship between innovation, learning and knowledge. The wide use of information extends the potential for codifying knowledge but at the same time it makes tacit knowledge scarcer and it contributes to the formation of 'a learning economy'. The argument is supported by an empirical analysis of survey data from Denmark showing that firms that introduce several organisational practices, assumed to characterise the learning organisation, are more innovative than the average firm.

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INTRODUCTION

Taken in its broadest sense, knowledge management is an ancient phenomenon. The competence of employees and how competences are combined into organisational capabilities have always been a key to economic performance and wise managers have always been aware of the need to utilise and develop knowledge in the interest of the organisation. But it is only recently that knowledge management has become explicit in the management literature. According to Larry Prusak (2001), the first conference that focused on 'knowledge management' took place in 1993. Today the concept has become commonplace all over the world. The major impact of making 'knowledge management' explicit is that this aspect of management is given more attention.

According to Prusak (2001), the concept has roots in three different management traditions: information management, the quality movement and human capital. These different perspectives give different emphasis to what knowledge management should accomplish. Their definition of what is valuable knowledge is different and the idea about what 'managing' knowledge means is different, making the future direction of knowledge management is difficult to predict.

There is little doubt that the information technology revolution has changed fundamentally the role of knowledge in the economy. It has given cheap and worldwide access to some types of information. It has also offered new tools both for handling information and for advancing processes of knowledge creation and

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innovation. Therefore it is not surprising that knowledge management for some scholars and experts primarily signifies the use of advanced software, the codification of tacit knowledge and knowledge sharing through information systems.

But as we shall argue below, the impact of the wider use of information and communication technology is complex and contradictory (Lundvall 1997). One of the major impacts is that tacit knowledge becomes scarcer and therefore managing this kind of knowledge becomes more important. Another consequence is the acceleration in the rate of change that brings us into 'a learning economy' where the capability to learn becomes more important than given sets of specific capabilities (Lundvall, 2003).

At the end of the paper, we present an empirical study based upon Danish Survey data where it is shown that there is a strong correlation between the introduction of multiple management techniques associated with 'the learning organisation' and the innovative performance of the firm. Danish firms that use many of these techniques are much more prone to introduce new products than firms that use few of these techniques, even after we control for size, sector and form of ownership. This implies that knowledge management, especially in sectors with rapid technological change, needs to focus more on the process of learning than on locating and allocating a given set of knowledge assets. Without forming learning organisations information systems do not contribute to the dynamic performance of the firm and such systems need to be designed in such a way that they support the formation, diffusion and use of tacit knowledge.

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So while, at first glance, the wide use of information technology points us toward a definition of knowledge management as increasingly related to the use of information systems and to the management of codified knowledge we argue that paradoxically it calls for giving the formation and use of tacit knowledge more attention than before. We conclude that one of the most important tasks of knowledge management is not to steer in detail the processes of knowledge creation but rather to create 'framework conditions' that stimulate agents within and outside the organisation to engage in interactive learning. Information technology is a helpful tool in this process but it is seldom 'the solution' to knowledge management problems. We end up by proposing that knowledge management is more of a 'social art' than a scientific discipline. Neither can knowledge management be reduced to a set of techniques. The fact that knowledge management operates close to the human mind makes it necessary for managers to operate with finesse and on the basis of intuition and wisdom.

ON THE CONTRADICTORY IMPACT OF INFORMATION TECHNOLOGY

There is a normative bias in Western civilization in favour of explicit and well-structured knowledge and there are permanent efforts to automate human skills. One historical example is the effort to transfer the knowledge of skilled workers into machinery connected with Taylorism. Present efforts to develop general business information systems and expert systems may be seen as symptoms of this bias. For the knowledge manager, codifying knowledge may be seen as a way to make the organisation less dependent on the employees (Lundvall, 1997).

But the business experience of firms that should be assumed to be world

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champions in managing knowledge, be it IBM, Hewlett Packard or Microsoft, is rather mixed, with ups and downs in performance (Eliasson, 1996). As can be seen from their history none of these organisations have been able to develop the perfect expert system to manage the firm. They remain highly dependent on the skills, know how and intuition of their top managers. Actually management is an area where codifying knowledge is most difficult and this is especially true for the management of knowledge (OECD, 2000). So far automating human skills has proved to be quite successful in relation to tasks taking place in a stable environment. The success of chess programs demonstrate that in games where the rules remain constant even very complex decision making may be programmed and automated.

The most important delimitation on codification efforts is a high rate of change in the environment. Where the rules or the problems encountered change the benefits from codifying knowledge are limited since codification tends to create routines that are unsustainable and inefficient in the long run (Hatchuel and Weil, 1995). Highly automated process industries may be extremely cost-efficient as long as technologies and markets remain stable but at some time when the products loose their competitiveness because of more attractive substitutes they leave behind them rust-belt problems.

The wider use of information and communication technology (ICT) enhances both the incentives and the possibilities to codify knowledge (David and Foray 1995). The share of knowledge that can be transformed from being tacit to becoming explicit information grows. The capacity to codify and to handle codified knowledge becomes more important in the firm. In this light it seems natural that knowledge management should be seen just as a further development of information management. It might even be considered that as a consequence the era of tacit knowledge is over.

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But this is only one side of the coin (Johnson, Lorenz and Lundvall, 2002). The other is that the very growth in the amount of information made accessible to economic agents increases the demand for skills in selecting and using information intelligently. So, as more skills are transformed into a codified form, demand will grow for complementary tacit knowledge. This is one reason why experience based learning becomes even more important than before.

But the most important reason is that the widened use of ICT speeds up change and the acceleration makes it less meaningful and attractive to engage in the development of codification and information systems. ICT speeds up change through different mechanisms. First the rate of innovation within ICT is high and its diffusion to all sectors of the economy imposes change on these sectors. Second ICT has become an important tool in speeding up innovation in several sectors including drug design in pharmaceuticals and physical design in most other sectors.

While the potential for codification of activities may be growing, more and more activities operate in contexts where rules and problems change more rapidly than before. Automation and introduction of codified routines in such activities will be costly and give dubious results. The capacity most in demand is to cope with new tasks and problems. This is why skills and know-how becomes scarcer and more important for performance than before.

If the main impact of ICT is a speed-up of processes of change, the use of information technology may be regarded from a different perspective where the emphasis is upon its potential to re-enforce human interaction and interactive learning. Here the focus is not upon its potential for substituting for tacit knowledge but rather upon how it can support the creation, use and sharing of tacit knowledge. E-mail systems connecting agents sharing common specific codes of communication and frameworks of understanding can have this effect. Communities of practise and

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epistemological communities tend to become increasingly important for the creation of use of knowledge both locally and globally. Wide access to data and information among employees can further the development of common perspectives and objectives for the firm. Interactive learning in external networks may be re-enforced by the intelligent use of ICT-technology.

A TAXONOMY OF KNOWLEDGE

One reason why it is difficult to design successful knowledge management is that 'knowledge is a slippery object' (Winter, 1987). If it is difficult to agree on what knowledge means it is of course even more difficult to agree on how to manage it. There have been different attempts to work out what are the most important distinctions between different kinds of knowledge and different taxonomies have been proposed (Lam 2000).

Knowledge may be embodied in people or built into artefacts. Much knowledge is collective rather than individual and it may be embedded in organisations or networks (Arrow 1994). Standing alone it is intangible and difficult to grasp. The very meaning of knowledge differs depending on context. A classical taxonomy makes a distinction between the four categories: data, information, knowledge and wisdom.

It is assumed that data are raw facts without internal organization. When structured and put into context they carry some meaning and become information. It is only when the human mind activates information that it gets the status of knowledge. Wisdom is assumed to bring in a deeper understanding and ethical grounds for action.

In relation to knowledge management we do not find this taxonomy very useful. Actually it fails to make some of the most important distinctions and by doing so it

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sometimes results in a biased understanding of knowledge as basically a cognitive category referring to the individual. This is problematic since procedural knowledge (know-how) both individual and collective (as shared routines) is a key to economic performance.

More than a decade ago Lundvall and Johnson (1994) introduced a different set of distinctions: know-what, know-why, know-how and know-who. [2]

Know-what refers to knowledge about 'facts'. How many people live in New York, what are the ingredients in pancakes and when was the battle of Waterloo, are examples of this kind of knowledge. Here, knowledge is close to what is normally called information - it can be broken down into bits.

Know-why refers to knowledge about principles and laws of motion in nature, in the human mind and in society. This kind of knowledge has been extremely important for technological development in certain science-based areas such as for example chemical and electric/electronic industries. To have access to this kind of knowledge will often make advances in technology more rapid and reduce the frequency of errors in procedures of trial and error.

Know-how refers to skills, such as the capability to do something. It might relate to the skills of manual workers. But actually it plays a key role in all activities in the economic sphere. The businessman judging the market prospects for a new product or the personnel manager selecting and training the staff have to use their know-how. It would also be misleading to characterise know-why as science-related and know-how as being for practical people. One of the most interesting and profound analyses of the role know-how is actually about how the advanced scientist makes research on the basis of personal skills (Polanyi, 1958/1978 and Polanyi, 1966). And

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conversely not all know-why knowledge is scientific. In everyday life, when interpreting what is happening, models of causality that have very little to do with science are applied by ordinary people.

Know-how is typically a kind of knowledge developed and kept within the border of the individual firm or the single research team. But as the complexity of the knowledge base is increasing co- operation between organisations tends to develop. One of the most important rationales for the formation of industrial networks is the need for firms to be able to share and combine elements of know-how. Similar networks may be formed between research teams and laboratories.

This is one reason why *know-who* becomes increasingly important. The general trend towards a more composite knowledge base where a new product typically combines many technologies and each technology is rooted in several different scientific disciplines, together with the speed up of change, makes it crucial to have access to many different sources of knowledge. Know-who involves information about who knows what and who knows to do what. But it also involves the social capability to co-operate and communicate with different kinds of people and experts.

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These distinctions are closer to everyday language than the first taxonomy. We prefer to use ‘information’ as part of knowledge rather than as something distinct from knowledge. We define information as knowledge that has been transformed into codes so that it can be saved in a computer and sent through electronic media. In the next section we will discuss what elements of knowledge can be transformed into information and the consequences for knowledge management of the wider use of information and communication technologies.

Know-how is perhaps the kind of knowledge where information technology and codification has the most to offer but also the one where the greatest barriers have to be overcome. Work on 'expert systems' shows that even when tasks are reasonably simple the operation of the expert system developed will differ from the actual operation of the expert (Hatchuel and Weil, 1995). Firms that have over-emphasized the use of business information systems in their decision-making process have often run into trouble (the problems of the business system’s giant IBM to develop a successful management strategy illustrate the point) (Eliasson, 1996).

Know-who sounds somewhat pedestrian as compared to ‘know-why’ and ‘know-how’ but actually it may have become the most important kind of knowledge in the learning economy. The combination of increasing complexity and rapid change makes it crucial to know who knows what and who knows to do what. Information technology has a role to play since it makes informal networks more efficient in overcoming distance in time and space.

It follows from the analysis of the four kinds of knowledge that information technology increases the stock of codified knowledge and that skill and competencies (tacit and explicit) related to the use of ICT- technologies become increasingly

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important. But it also follows that the rapid change that is a major consequence of the wide use of ICT gives an even stronger weight to tacit skills. This is one reason why outstanding experts in management, finance and science get even better paid in the learning economy. If their skills could readily be transferred to expert systems we would expect to observe a very different development of income distribution.

Collective tacit knowledge also tends to grow in importance. Especially in fields where the rate of innovation and knowledge creation is high there will be a growing tendency to takeover other organisations with the collective tacit knowledge that they embed.

INNOVATION AND KNOWLEDGE CREATION

A problem with linking organisational forms to economic performance is that it is difficult to develop valid and reliable indicators both for organisational forms and for economic performance. Do specific management techniques promote learning? Do they contribute to knowledge creation? Without some systematic analysis of these issues we have to rely on 'story-telling' about the success of specific changes in specific organisations. But it is well-known that transferring a 'best practise' from one context to another is highly problematic (Lundvall and Tomlinson, 2002). to overcome this problem is to link to each other innovation, learning and knowledge creation. Innovation represents – by definition – something new and therefore adds to existing knowledge. Actually, many authors using the concept of knowledge creation and knowledge production refer to technological knowledge and to technical innovation as the output of the process (Antonelli, 1999; Nonaka and Takeuchi, 1995). In new growth theory, the output of the R&D sector is viewed either as a blueprint for a new production process that is more efficient than the previous

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THE LEARNING ECONOMY AS CONTEXT

We see the information technology revolution as one major factor behind the formation of 'the learning economy' (Lundvall, 2003). The term marks a distinction from the more generally used term 'the knowledge-based economy'. The learning economy concept signals that the most important change is, not the more intensive use of knowledge in the economy, but rather that knowledge becomes obsolete more rapidly than before. Therefore it is imperative that firms engage in organizational learning and that workers constantly develop new competencies. The increased rate of change can be illustrated by the fact that it is claimed that half of the skills that a computer engineer has obtained during his education will have become obsolete one year after the exam has been passed, while the 'half-life' of skills for all educated wage earners is estimated to be eight years (Ministry of Education 1997, p. 56).[3]

A learning economy is thus one in which the ability to attain new competencies is crucial for the success of individuals and for the performance of firms, countries and regions. The background for the crucial importance of learning is that the combination of globalisation, information technology and deregulation of formerly protected markets leads to more intense competition and to *more rapid transformation and change*. Both individuals and companies are increasingly confronted with problems that can be solved only through forgetting old and obtaining new competencies. The rapid rate of change is reinforced by the fact that intensified competition leads to a selection of the outlines of the learning economy perspective were first sketched in Lundvall (1992) and further developed in Lundvall & Johnson (1994). The analysis has much in common with ideas developed in Drucker (1993) but was developed without direct inspiration from this source.

organizations and individuals that are capable of rapid learning, thus further accelerating the rate of change.

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A striking characteristic of knowledge production resulting in innovation is that knowledge, in terms of skills and competencies, may be perceived as the most important input. In this sense, it recalls a 'corn economy', in which corn and labour produce more corn than is used up in the process. But it differs from such an economy in one important respect. While the corn used to produce corn 'disappears' in the process, skills and competencies improve with use. Important characteristics of knowledge reflect that *its elements are not scarce in the traditional sense*: the more skills and competencies are used, the more they develop. This points to knowledge production as a process of joint production, in which innovation is one kind of output and the learning and skill enhancement that takes place in the process is another.

It is tempting to see innovation as a linear processes and to assume that new scientific results are the first step in the process, technological invention the second step, and the market introduction of innovations as new processes or products the third. There is now a rich body of empirical and historical literature that shows that feedback loops are fundamental and that the one-way road from new scientific results to the new product is the exception rather than the rule (Rothwell, 1977; von Hippel, 1988; Lundvall, 1988). The recent models of innovation emphasize that knowledge production/innovation is an interactive process where the interaction of firms with customers, suppliers and knowledge institutions is crucial for the outcome. Empirical analysis confirms that firms seldom innovate alone (Christensen and Lundvall, 2004).

COMPETENCE AS THE OUTCOME OF KNOWLEDGE PRODUCTION

The change from a linear to an interactive view of innovation and knowledge production has also been a way to connect to each other innovation and the further development of competence. The innovation process may be described as a process of *interactive learnin*g in which those involved increase their

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competence though engaging in the innovation process.

In economics, there are various approaches to competence-building and learning. One important contribution is Arrow's (1962) analysis of 'learning by doing', in which he demonstrated that the efficiency of a production unit engaged in producing complex systems (airplane frames) grew with the number of units already produced and argued that this reflected experience-based learning. Later, Rosenberg (1982) introduced 'learning by using' to explain why efficiency in using complex systems increased over time (the users were airline companies introducing new models). The concept of 'learning by interacting' points to how interaction between producers and users in innovation enhances the competence of both (Lundvall, 1988). A more recent analysis of learning by doing focuses on how confronting new problems in the production process triggers searching and learning, which imply interaction between several parties as they seek solutions (von Hippel and Tyre, 1995).

It follows from our analysis of innovation and competence-building that a move towards learning organizations needs to be reflected in changes both in the firm's internal organization and in its inter-firm relationships. Within firms, the accelerating rate of change makes multi-level hierarchies and strict borders between functions and departments inefficient. It makes decentralization of responsibility to lower-level employees and formation of multi-functional teams a necessity. This is reflected in the increasing demand for workers who are at the same time skilful, flexible, co-operative and willing to shoulder responsibility.

LEARNING ORGANIZATIONS AND INNOVATION – THE DANISH CASE

In what follows we will show that the probability of successful product innovation increases when the firm has organized itself in such a way that it

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promotes learning. Second we will demonstrate that organizational forms promoting learning are multi-dimensional - they typically combine several of a number of internal and external relationships and activities.

METHODOLOGY

The empirical analysis is based on a survey addressed to all Danish firms in the private sector – not including agriculture - with 25 or more employees, supplemented with a stratified proportional sample of firms with 20-25 employees. In turn 6991 questionnaires were sent to the firms selected. This survey collected information from personnel or human resource management. In total, 2007 usable responses from management have been collected and integrated in a cross section data set. This makes the overall response rate of the survey 29%. A closer response analysis, broken down by industry and size, show acceptable variations on response rates. Non-respondent information on some of the potential dependent variables together with comparison to other surveys, do not indicate unacceptable bias (Lundvall and Nielsen, 2005).

Obtaining a meaningful quantitative measure of innovation and innovative behaviour on the basis of information collected in firms belonging to industries with very different conditions, is not unproblematic. The phenomenon that firms refer to may vary in relation to conditions and configurations. Our data indicate that we are confronted with incremental qualitative change rather than radical change when firms declare that they, in the period of 1998 - 2000, have introduced new products or services on the market. Three fourths of the innovations introduced within the period 1998-2000, were already known at the national as well as on the international markets. 13% of the firms have introduced at least one product or service innovation new for the national market, although already existing in world markets. A small group of firms (6%) have introduced at least one innovation new both on the national

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and the world market.

In the survey, we measured the incidence of an array of organizational dimensions, which all directly or indirectly refer to contemporary theories dealing with the relation between communication, knowledge transformation, interaction and learning in relation to innovation in organizations. In this way the dimensions become our operational expressions of 'the learning and innovating organization': cross occupational work groups, integration of functions, softening demarcations, delegation of responsibility and self directed teams are empirical indicators, referring to Moss Kanter's theory of integrative organization (1983) and Burn's & Stalker's organic organizations (1961). Quality circles and proposal collection systems are indicators of Quality management and Knowledge Management (Nonaka & Takeuchi 1995). Tailored educational system and educational planning indicate Human Resources Development (Bratton & Gold 2003) and cooperation with external actors refer to innovation as an interactive process (Lundvall, 1992). In Table 1 the dimensions are classified in relation to theoretical aspects.

We find a five times higher chance of P/S innovation in the high level category, and even in the medium category the chance is twice as high as in the low category, which is used as a baseline. Among the other factors included in the model, Manufacturing and Business Services remain significant with 2.3 higher chance of P/S innovation and Construction is negatively significant with a chance of 0,7. The effect of large size (100+) is positive but moderate. Danish group ownership and single firms have a chance below the benchmark category (foreign-owned firms). In sum, the model has shown important and significant effects of the development of what we call learning organization on P/S innovation.

This illustrates that 'learning organizations' that combine functional

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flexibility with investment in human resources, incentive systems and networking are much more prone to innovate irrespective of sector and size. It also illustrates that there is no clear distinction between 'innovation management' and 'knowledge management'. The organisational characteristics that promote adaptive learning also promote innovation. To install them is an important an important task both for 'knowledge managers' and 'innovation managers'.

It does not follow from the analysis that the adoption of any single of the characteristics used to classify the learning organisation will enhance the capacity of the firm to innovate, learn and create new knowledge. The context matters and we find that in certain sectors where change is slow such as construction and transport firms may survive and prosper with little effort to engage in innovation and learning. But it indicates a general direction for how knowledge management may enhance the dynamic performance of firms in sectors where there is rapid change in technologies and customer needs.

It is interesting to note that organisational forms that are often thought of as stimulating 'learning as adaptation' also seem to be supportive of knowledge creation and innovation. As argued above innovation, competence building and adaptation are intertwined, and promoting one is a way of promoting the other. The distinction between HRM, knowledge management and management of innovation as different analytical fields and as the responsibility of distinct professions may therefore be worth to reconsider.

CONCLUSIONS

In the first three sections we discussed knowledge management in the light of the contradictory impact of information technology on the relationships between tacit and codified knowledge. We argued that paradoxically the wide use of information

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makes tacit knowledge more crucial for the performance of the firm. In the third section we went a step further and argued that the information technology revolution has given rise to a new type of economic dynamics at the macro-level and we referred to this as 'a learning economy'. In the learning economy the dynamic performance will reflect the capability to build new competences and to respond to change. In the fifth section we tested this hypothesis on the basis of Danish data and showed that that learning organization characteristics have a positive impact on dynamic performance.

Therefore it might be a good idea to think carefully about what should be meant by 'managing' in the context of knowledge management. If 'management' refers to an ambition to give managers complete control of what employees learn, 'knowledge management' would damage the dynamic performance of the organisation. Little space would be left for individual and collective creativity and for the use of intuition. The alternative is to establish 'framework conditions' – both organisational and cultural - promoting efficient use, creation and diffusion of knowledge and then to leave the process to evolve as best as it can. Actually, we have argued that this second model is much closer to representing 'best-practise' for organisations exposed to strong competition and operating on the basis of on-going innovation.

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